Systematic Assessment and Management of Information Technology Needs in a Hospital

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Abstract

In this paper, we have shown the various business processes \cite{2, 3} of a hospital in terms of its various departments using a flow diagram. We have then analyzed the current system in the hospital using the score card mechanism \cite{4, 5, 6}. We have then highlighted the different information technology components \cite{1} used in the current hospital system. Finally, we have provided recommendations for the new system with their costs and benefits.

1. Introduction

In order to analyze the different business processes (departments) of a hospital, we have taken the case study of Surrey Memorial Hospital (SMH) in Surrey, British Columbia. SMH \cite{12} was found in 1959 when the population in Surrey was a little over 50,000. Today, Surrey memorial is the largest acute care site in Fraser health with about 450 acute care beds and the busiest Emergency department in the entire province. SMH comes under the Fraser Health group of hospitals and has been undergoing $512 million expansion and redevelopment ever since January 2011. Their main aim is to provide the best possible health care for the growing population of Surrey and the neighboring regions and would have 151 new beds, a state-of-art critical care tower, an expanded emergency department and major renovations to parts of the existing hospital including the addition of a new helipad and more parking space to serve the patients better.

2. Departmental divisions

Like any other general hospital, Surrey memorial has the following wings:
A sample UML use case diagram for a hospital reception could be as follows:

Hospital subsystem has tons of jobs available one of them being that of a receptionist. The different departments might not be directly linked, they have the common reception that joins them and puts them together. A receptionist records patient’s personal contact information and contacts them as may be required. They have the allotted room numbers and also records of their payments, files, receipts and reports.

As well, the sample pathway of a patient who comes in an emergency situation can be described as follows:

The patient would come in after an accident and register at the reception following which he would be admitted to the “Emergency” ward. He would be dealt with by the workers of the “Urgent care” department who would make the first few fixes and then transfer him to the “Intensive care Unit” for keeping a close eye on him and his body reactions.

After that, he would be moved to the “Post anesthesia care unit” to make sure he has recovered from all the anesthesia injections that would have been given to him to reduce his pain. Next, he would be analyzed by the “Acute assessment” department which would recommend him to “Physical therapy” and slowly make his visits “On call”. The patient would finally be discharged once he has been deemed treated by his “On call room” check up doctor.

3. Score card

The following is a sample score card that can be used to draft the results of surveying the doctors and nurses at Surrey Memorial Hospital in order to suggest improvements. The surveyors can be asked to answer only questions applicable to them and limited to their extent of work and knowledge:
### Present Equipment

<table>
<thead>
<tr>
<th>Present Equipment</th>
<th>Are you satisfied with its performance?</th>
<th>Which aspect would you want to improve about the machine best?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyzer, HPLC by BioRad</td>
<td>Generally yes, but at times frustrating</td>
<td>Speed and number of loads it can store</td>
</tr>
<tr>
<td>Analyzer, ICP by Thermo Scientific</td>
<td>Yes</td>
<td>Not frequently used hence none</td>
</tr>
<tr>
<td>Analyzer, Immunoassay by Siemens, Roche</td>
<td>No</td>
<td>Faster version needed with more versatility</td>
</tr>
<tr>
<td>Autoclave by Steris</td>
<td>No</td>
<td>Bigger storage space or more autoclaves</td>
</tr>
<tr>
<td>Automated Blood Bank by Ortho-clinical diagnostics and Immucor</td>
<td>Yes</td>
<td>Very efficient - none</td>
</tr>
<tr>
<td>Automated Chemistry line by Beckman Coulter and Roche</td>
<td>No</td>
<td>Limited Space – need more</td>
</tr>
<tr>
<td>Automated Chest Compression Device by Physio Control</td>
<td>No</td>
<td>Newer versions are available and should be introduced for ease of use</td>
</tr>
<tr>
<td>DAS, DICOM Application Services Server by Sun Microsystems</td>
<td>No</td>
<td>Too slow and tedious</td>
</tr>
<tr>
<td>Hemodialysis Unit by Bellco</td>
<td>No</td>
<td>Too complicated for one machine alone</td>
</tr>
<tr>
<td>Incubator, Infant, Transport by AirBorne</td>
<td>Yes</td>
<td>None</td>
</tr>
</tbody>
</table>

### 4. Requirements for the new process and suggested improvements

#### 4.1. Analyzer HPLC:
At present the staff is using the Biorad Analyzer [13] for these purposes. It does perform the basic task of identifying compounds and also provides automated diabetes monitoring platform. This machine is outdated in its size though, as machines much more compact than this one are now available for use. As well, this system is very specific to diabetes whereas systems a lot more versatile are now available for use. Considering the results from the score card, it might be best to upgrade to something like G8 HPLC Analyzer by TOSOH. Not only does it have the latest specifications, it also has 90 to 290 sample loader availability which means it would work much faster.

#### 4.2. Analyzer ICP:
This current product [15] at SMH has a wavelength range of 166-847nm and a speed of 0-125rpm. It has quite a few installation requirements and needs to be kept in an air conditioner for temperature and humidity control. It has a glass cyclone gas chamber and contains a plasma, nebulizer, and auxiliary gas in it to perform its testing perfectly. This is not as common and hence should be able to continue as it is.

#### 4.3. Analyzer immunoassay:
This one by Roche [15] has a frequency of 50-60 Hz. This product by Siemens has almost the same frequency and needs the same amount of power input as well. Although, Siemens machine is much lighter that Roche, which Siemens being 166kg and Roche starting at 425. This machine is used for a variety of purposes and has at least 40 different systems made by more than 19 different companies. Hence, the choices are quite a few and the systems should definitely be upgraded to provide better service since it is a machine which can be used to do so much.

#### 4.4. Autoclave:
Autoclave is an extremely important machine common to almost all departments since it does the integral job of sterilizing materials. Almost every object has to be sterilized in a healthcare facility. Considering that the automatic startup and shutdown facility of the product can be very helpful. Steam purge and water saving control is important as well since it does need a lot of water at high temperatures to kill bacteria. The only main improvement is to provide more space for vessels in the machine; or else more machines altogether. Priorclevana [14] are quite famous for autoclaves.
4.5. Automated Blood Test: This does a variety of tests on blood to determine the different disease states and also enhances disease monitoring and patient management. It’s need a stable room temperature of 18-28 to function and is very important since blood test is a extremely common test for most people. Its only limitation is it can’t be placed in close range with anything that produces heavy vibrations. These have not really developed in the past two years, although this technology is already the best in SMH. This does save a lot of time though and is therefore very helpful.

4.6. Automated Chemistry Line: This does a lot of things like analyzing and configuring compounds. It is a different layout for every laboratory and company but the best use of space while yet ensuring cleanliness remains the key issue. The changes that can be made to this can only be done to better suit the room they have been kept in to minimize space utilization. The space provided for each should not too much and not too little.

4.7. Automated Chest Compression Device: This device [16] is very light weight and easy to use for effective compressions. There is even a battery version available and it helps maintain good blood flow and perform safe CPR. Any patient with a sternum height of 6.7 to 11.9 inches can use it and it is not restricted by weight. Medtronic has been selling a newer version of it for a while now after it was approved by FDA and can be used to upgrade technology.

4.8. DAS, DICOM Application Services software: This software runs on Sun Microsystems using the SUN Fire V100 server. Its best part is that its remotely accessible and can support up to seven modality connections per server. Sun Microsystems however has become old and newer mechanisms coming forward from Oracle and other such companies for database management. These could be implemented for faster response.

4.9. Hemodialysis Unit: The hemodialysis [17] unit makes use of the reverse osmosis principle. It helps with the thermal chemical disinfection and hence needs to be taken care of specifically. Able Global healthcare showcases the newer, easier to use machines available for hemodialysis and if a change is needed, it should be made.

4.10. Incubator infant transport: This is highly effective for hospitals that do not have a dedicated ambulance system for neonatal support. But since SMH is underway in constructing its neonatal specific wing, it can be recommended that these be replaced by dedicated incubators specifically installed in ambulances. These can still be kept as they are light weight and easily fitted with the standard adult stretchers. It has all the usual oxygen blender, skin temperature probe and noise level control features. Hence, for emergencies and special needs they can still be used as substitutes for the dedicated ones, as suggested in the score card report.

5. Role of information technology in business development plan

IT [7, 8, 9] plays an integral role in the development of anything in healthcare. Infact, biotechnology is the most advancing field at present. As seen above, most upgrades for equipment have come in the form of advancements in technology. Newer, smaller products are only created when IT takes toll and develops new devices that allow this transmission [10, 11]. Everything is computerized now-a-days and hence almost everything that needs to be upgraded, even infrastructure, is planned keeping latest technology in mind.

6. Costs and benefits

The costs of the advancements are only received once the hospital actually decides to upgrade. Because of the nature of the equipment, quotes are only sent out on special requests to legitimate customers. The benefits of course are to further support the medical department and serve the patients faster. It makes the healthcare more reliable and less painful for the patients.

7. Conclusion

This research paper provides a description for a new business process plan for a hospital as part of its various system updates and maintenance. This is accomplished with the help of strategic planning and combining the relationship between the hospital’s business information systems and its strategy. Using the score card mechanism, we have analyzed the various benefits of the new system.

8. References

[13] www.diagnostics.us.tosohbioscience.com/Products/G8+HPLC+Analyzer/